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The Outdoors

Studies for Woodlands

METRIC EDITION

David Bates

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The Outdoors

Studies for Woodlands

Ryerson Science In Action

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METRIC EDITION

David Bates, B.A.

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D.B.

David Bates is an Assistant Professor of the Faculty of Education at Lakehead University.

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TO THE TEACHER

This book is a guide for early studies of a woodland. Children from the middle years of public school should be able to do many of the suggested studies, while some activities could be quite stimulating for older students. In effect, the questions and directions are the same, but experience, investigative skills, and maturity serve to make the observations and conclusions of older pupils much different from those of younger pupils.

In fact, any adult or young person curious about the nature of the woodlands might use parts of the book with profit.

A First Look at the Woods and A Closer Look are, in the author's view, the most important parts of the book. It is through experiences such as those suggested there that one must see the woodland as a community with many components. Each of the parts—small animals, sun, trees, soil, moisture, dead leaves, and the rest—is affected by the others, and in turn affects them. No introductory study should fail to emphasize this aspect.

More Investigations is a series of activities to encourage study of selected parts of the woodland. Many are guides to observations. Few require much more than pencil and notebook, with a hand lens a desirable supplement. Any special pieces of equipment are relatively simple to make.

Some of the activities can be used as a formal "lesson". Activity 1 in Plants is such that a whole class could be dispersed in groups and be expected to complete the activity well on any given day. Some are best used as incidental studies to be used when an opportunity arises. For example, it is not possible to count on enough squirrels being present on a given day in order that a whole class can do Activity 3 in Mammals.

The teacher does not need to be a naturalist in order to begin studies of the outdoor environment. Use activities that lend themselves to treed areas near the school for a start.

Activity 2 in Plants is an example. Activity 2 in Soil is another. Formal studies of one-half to several days have their place, but frequent short excursions are far more likely to encourage observation, appreciation, and consideration of the natural environment. Many activities can be done over several successive days so that forty minutes or an hour can be used well. There should be very little "teaching", as the students do the activities, but there is much scope for sensitive assistance to pupils. Imagination and persistence are important teacher characteristics in making the most of what is available.

Records kept over a period of years will contribute to the awareness that you and the pupils have about the natural environment.

More than anything else, this book should encourage classes to make regular studies of the environment near the school. The parallel *Studies for Open Places*, and the six companion books in the Science in Action series, will also assist pupils to delve more deeply into the fascinating world out of doors.

Choosing and Caring for Study Areas

Outdoor study areas can easily be ruined. As little as one year of fairly heavy use can make an area unsuitable for further study. Some areas may recover in a year or two. Others take longer.

If the only rotten log or stump within a useful distance of the school is destroyed, there will not be another one for perhaps ten years, perhaps never. Lichens and similar simple plants are easy to destroy and difficult to replace.

A simple rule is NO COLLECTING. Certain exceptions may be made with caution. Most trees have enough leaves so that a few taken will cause little harm. Twigs collected carefully can be justified. In most cases a diagram or photograph would be just as useful.

Mushrooms, toadstools, fungi, lichens, birds' nests are uncommon enough to demand special effort in maintaining them. On the other hand, small quantities of leaf litter and topsoil will not likely be serious losses to the forest or other community, nor will small numbers of common plants and insects.

Senior classes in which a small number of pupils do intensive, specialized studies may reasonably use a very small number of selected specimens.

No collecting is ever justified if it in any way despoils the environment, or if the material is scarce, is on private land, is in parks and other protected public areas, or will not be used effectively.

Equally important is a DO NOT DESTROY rule. Not only does this make future study difficult or impossible, it usually makes the area much less attractive. Appreciation of natural resources is one of our objectives.

When choosing an area for study, consider the following.

Will it handle the number of students? Trampling, turning over of soil, looking under logs and rocks, and similar activities, even when done carefully, will cause an area to deteriorate. Make every effort not to use the same area year after year. Rotate among several areas as much as possible.

Is there enough variety? Several kinds of communities should be available for study. Distinct contrasts are often necessary for children to notice the effect of different factors on the plants and animals. A stream is most desirable. Hills provide a variety of soils and exposure conditions not found in flat regions. North facing slopes and south facing slopes show interesting contrasts. Some lowland, marshy or swamp conditions are desirable. But, variety is only part of the problem. One modest stream will not be sufficient for many students for long, neither will a small wet area. They are easily damaged and are slow to recover.

Is there an easy access from the school? An area easily used

is more likely to be used often. Every complication reduces the chance that a class or group will study outside.

Needs vary. A teacher looking for some study places for one class can make do with relatively little if the areas are carefully chosen and cared for. Six classes intending to make reasonably complete studies will probably find few twenty-acre woodlots with the quantity and variety of material necessary.

Choose an area carefully, work well within its capacity, and treat it with respect.

Some Skills to Consider

Teachers should consider the development of skills. Here is one general approach.

The skill	*What the pupil does when using the skill*
Observing	—uses the five senses to detect details, similarities and differences
Collecting	—gathers information, materials etc. into one place
Organizing	—sorts materials, data etc. into a meaningful scheme
Recording	—makes notes, constructs graphs, charts, diagrams
Discriminating	—selects irregularities in a situation
Hypothesizing	—suggests a theory to explain what is not completely understood
Observing relationships	—notes connection between one variable and another
Experimenting	—uses equipment to demonstrate or test an hypothesis
Control of variables	—purposefully handles the changeable aspects of an experiment
Predicting	—weighs data to indicate further events

Making inferences —uses induction or deduction to present a possible solution

Forming generalizations —reduces information to general laws or rules (the conclusion may be tentative)

Before children commence an area of investigation, it is useful for the teacher to state behavioural objectives. This type of planning would include:

an initial statement of intent;

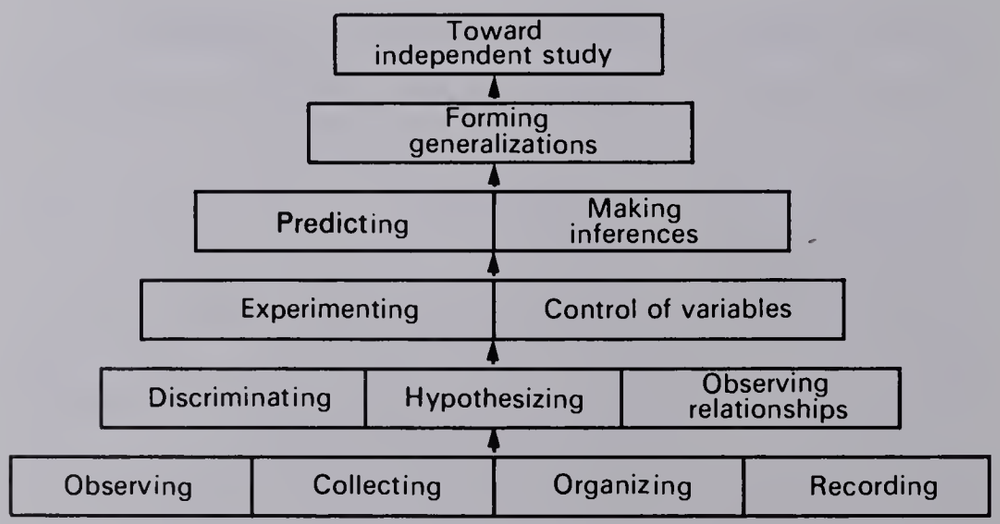
a general description of the over-all behaviour in qualitative and quantitative terms;

a definition of important conditions;

a criterion to measure performance.

It is suggested that the general skills shown above be used as beginnings for the development of behavioural objectives to meet specific needs. Meaningful planning can best be done by the people directly involved. For an excellent but short reference for setting educational objectives, see Robert F. Mager, *Preparing Instructional Objectives*, Fearon Publishers, Palo Alto, California, available in Canada from Clarke Irwin & Co. Ltd., Toronto.

AN INTERESTING ENVIRONMENT



TO THE PUPIL

This book is your guide to knowing the woodlands better. Take it with you when you go out of doors.

Prepare materials before you go. Have a good idea what the purpose of the study is, but do not let that stop you from seeing many other things.

Ask your teacher for help if it seems necessary, but hope that he or she does not tell you too much. The excitement is in finding out for yourself. A few mistakes will not do any harm.

For most of the questions asked in the book there are no "right" answers. Different times and different places mean different kinds of answers.

Outdoor areas can be spoiled easily. DO NOT COLLECT SPECIMENS. On rare occasions the teacher may suggest that a few leaves, insects or other things may be collected with little harm. Those should be the only times things are brought back to the classroom.

Similarly, do not destroy things you study. Put rocks back in streams, return logs to their original positions, do not break up rotten stumps, and leave everything so others can enjoy them.

Many observations in the woods will be of things that change. If you observe them several times, at different times of the year or over a long period of time, you can learn a lot. You can learn much more in this way than by making only one observation.

For example, look under rocks in the riffly parts of streams once each season. What you see in the Fall may be much different than what you see in the Spring. Watch the flowers that come up in the woods in the Spring. Are they the same each year? Do the flowers on the maple trees come out at different times each year? Observations several years in a row may help to provide answers to such questions.

Noises make most animals hide. Walk quietly and slowly through the woods. Do not talk with friends. Instead, use hand signals and whispers to avoid disturbing animals.

One of the best ways to find out what goes on in a woodland is to find a nice place and sit there very quietly. Watch closely what goes on around you. Take with you a notebook, pencil and perhaps binoculars and a few field guides. In this way you may see many little animals—worms, spiders, ants and others, as well as larger animals such as birds or perhaps deer.

A blind, such as the one suggested on page 44, is useful. You can hide in it so that animals cannot see you.

A FIRST LOOK AT THE WOODS

Your study of the woods might begin with a pleasant, not hurried, walk. By doing this you will begin to see some of the things which make a wooded area different from other places. If you walk through open places before you get to the woodlands the differences may be clearer to you.

There are many things to see. You will be able to come many times to see new things and learn more about the woodlands. First look at some important things about woods; later you can look more closely at details.

The Climate

On a sunny day you will note a change as you leave the field and enter the woods. No longer does the sun warm you. The air may seem cooler.

You could say that the *weather* in the woods is different from the weather in the open field. We will use the word climate when referring to things like sunshine and temperature.

Record what you notice about the woodland climate. Here are some suggestions.

—In what ways does the woodland climate differ from the open place climate?

—Are some sections of the woods sunnier than others?

—Are some more exposed to cold winds?

—Would some get more rain? Why?

—Do all sides of a tree have the same climate?

—Are the plants on the shaded side of a rock the same as those on the sunny side? Why?

—Do certain kinds of plants seem to prefer shaded areas? Give reasons.

—What differences can you see between the growth away from the woods, the growth at the edge of the woods, and the growth in the woods?

The careful, observant student will find many interesting features of the woodland climate and its effect on the plants, and animals that live in it.

The Soil

Most of the woodland plants grow in the ground. The soil is a very important part of the woods. The following questions can help you to learn more about the soil.

—How deep is the soil?

—Is the depth the same in all parts of the woods?

—How steep are the hills?

—Are some hills too steep for trees to grow on them?

—Do some sections of the woods have wetter soil than others? Where? Why?

—Of what is soil made?

—What are some types of soil that you can find in different parts of the woods?

—What differences are there between surface soil and deep soil?

—How does the soil seem to affect the growth of plants?

—Do some kinds of plants prefer wet soil? What kinds grow in dry soil? Do trees need deep soil?

—Are there some places in the woods where there is no soil? Do some kinds of plants grow where there is no soil?

Living Things

Climate and soil are not living things, but the woods have many living things. Many of the later activities will help you to know them better.

There is one important feature of life in the woods that can be studied now. Other things can be related to it.

Some people say that the woods have different levels, or layers. They are usually said to have four levels of plant growth.

The highest or upper level is the leaves at the tops of the trees. See how they form a roof over your head.

The lowest level is the layer of plants, such as mosses, that grows on the forest soil. These plants are the carpet on the forest floor.

Which plants seem to you to form the two middle levels of the forest?

A walk like this gives one many chances to see some general features of the woods. Now focus your attention on a small section.

A CLOSER LOOK

For this study, choose a small section of the woodland where the climate, soil, and kinds of plants are similar. Groups of two or three could pick other parts of the wood so that comparisons may be made.

Your study should include at least the following. Records should be kept in chart form and should contain information collected at different times of the year. This will help you to see that the wood has many faces.

The Climate

Sunlight

How bright is the area? How many hours of direct sun are there?

Wind

Which directions are open to the wind? Which are sheltered?

Temperature

Is it cooler, or warmer than in an open place? Is it cooler, or warmer than in other places in the woods? Record temperatures in sunny and shady spots, in animal holes and in water. Compare and explain the differences.

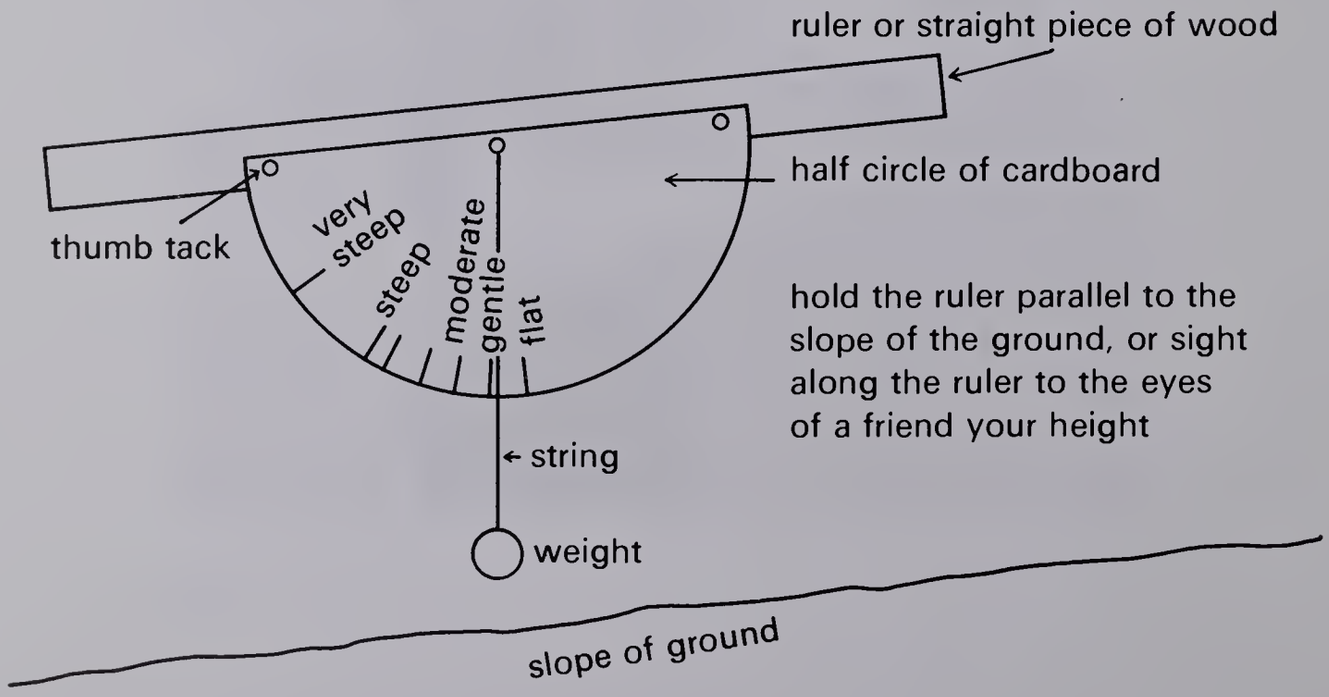
Moisture

Is there shelter from rain? Does the area seem to receive a lot of rain, a little rain, or medium amounts? Does the area seem damp?

The Soil

Slope

Is the ground flat, or is the slope slight, fairly steep, or very steep? This instrument can be used to estimate the slope of the ground.



Depth

How deep is the soil? Does it vary in different places in the area?

Type

Is the soil sandy, clayey, or a mixture? Does it have dead plant material in it? What does the surface soil look like? What does the soil one foot down look like? Observe the colour, smell and "feel" of several samples.

Moisture

Is the soil wet, moist, or dry? Is it the same at all depths? Does it look as if it holds moisture well? You might plan an experiment to find out. The *Studying Soil* companion book contains some suggestions.

Living Things

Levels of Life

Which of the four plant levels mentioned earlier are present in your area? Try to name the kinds of plants in each level. If some of the levels are missing, suggest reasons why.

What effects do the higher levels have on lower levels?

What evidence do you have that animals are living at different levels?

These studies have been simple studies of the ECOLOGY of woodlands. What does your dictionary say *ecology* is?

You have taken a closer look at one COMMUNITY in the woods. What definition of *community* may be used here? Is there a similarity between a community of people and a community of plants and animals in the woods?

Other Activities

This introduction to the ecology of the woodland suggests many ways in which to follow special interests. For example:

1. Obtain weather records for several years from your local weather station. Pay special attention to average hours of sun, number of frost-free days in a year, wind conditions,

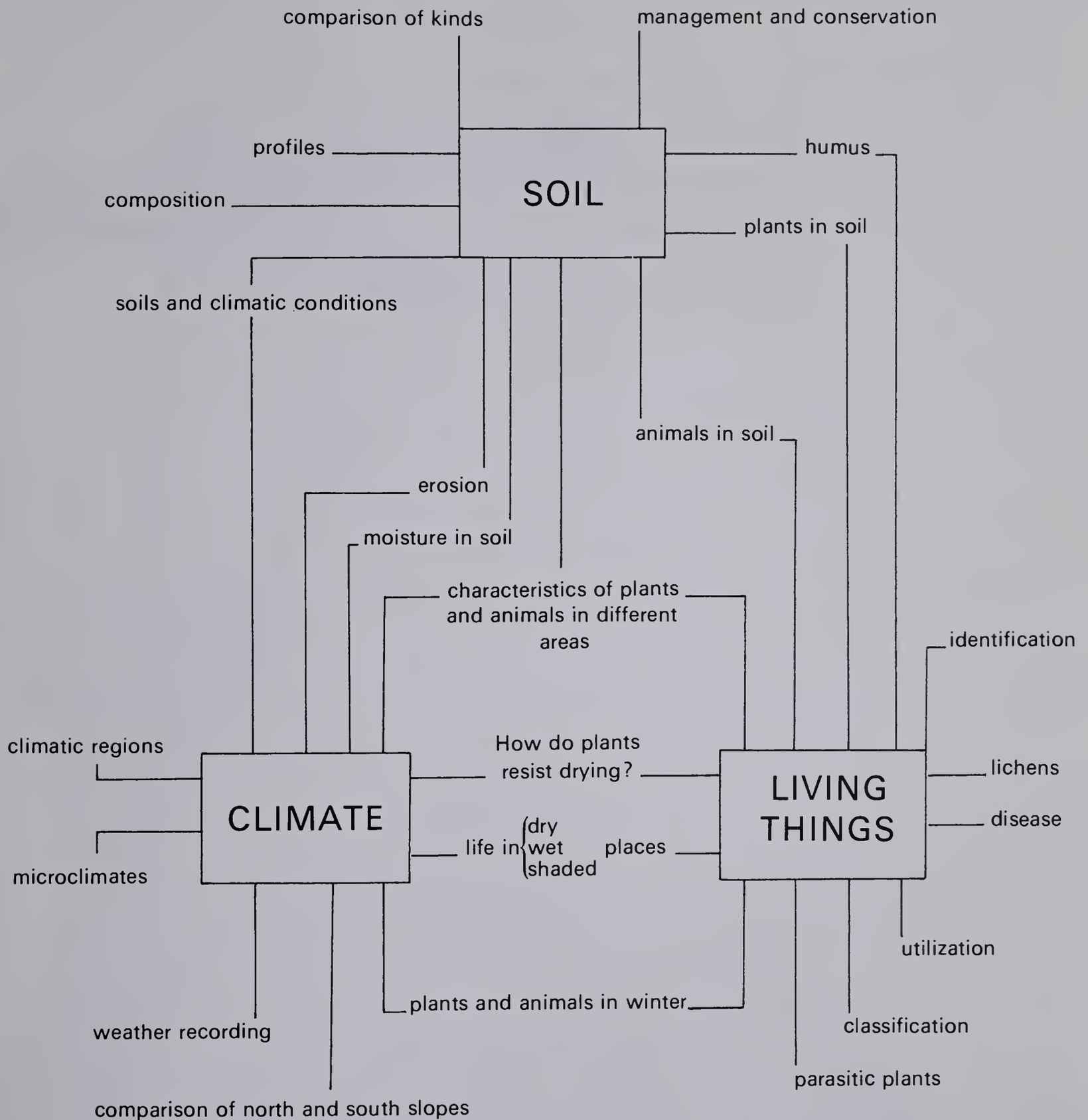
average temperatures in different months, temperature extremes, rain and snow in different months, and soil temperatures at different months. Relate these to the kinds of plants and animals in your area.

2. Measure as many things as possible. Temperature, humidity, soil depth, and rainfall are some suggestions.
3. Compare your area with other areas.
4. Make observations in different seasons.
5. Measure the water content of soil samples.
6. Photograph your site, soil samples, plants, and other things.
7. Collect, mount, and name the important kinds of plants. Use care and do not collect rare or slow-growing kinds; do not collect more than you can use.
8. Make a map of the area you studied. Make it to scale: use symbols to represent different kinds of plants. See *Studies for Open Places* in this series of books for suggestions.
9. Sketch some of the flowers, trees, and animals you find.

Ninety in the Shade

So hot by the afternoon
a rock on the cooler
side of the garden
tilted slightly and three
fat sleepy slugs
invited me under.

Raymond Souster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composition
plants in soil
soils and climatic conditions
animals in soil
erosion
moisture in soil
characteristics of plants and animals in different areas
identification
climatic regions
How do plants resist drying?
lichens
CLIMATE
LIVING THINGS
disease
life in dry wet shaded places
microclimates
utilization
plants and animals in winter
weather recording
classification
parasitic plants
comparison of north and south slopes

MORE INVESTIGATIONS

You have seen that plant life in the woods tends to form layers. Remember this when you are doing the activities on birds and other animals.

Do some animals move from one layer to another? Do others tend to stay in one layer? Make observations which test your opinions.

Only a few plants and animals will be studied in these activities. Watch for others. They will also be interesting to study.

Birds

Activity 1:
BIRD HOMES

The forests and woods of the world are the homes of many birds. Some live on the ground, some in trees, some in shrubs, and some in other places. Different parts of the woods—the swamps, the edge, the treetops, and the floor—provide many homes. Some birds nest in cedar trees, while others live in maples. Why? In this activity you will look for the answers. You will come to know birds better.

MATERIALS

Binoculars, if possible
Notebook and pencil

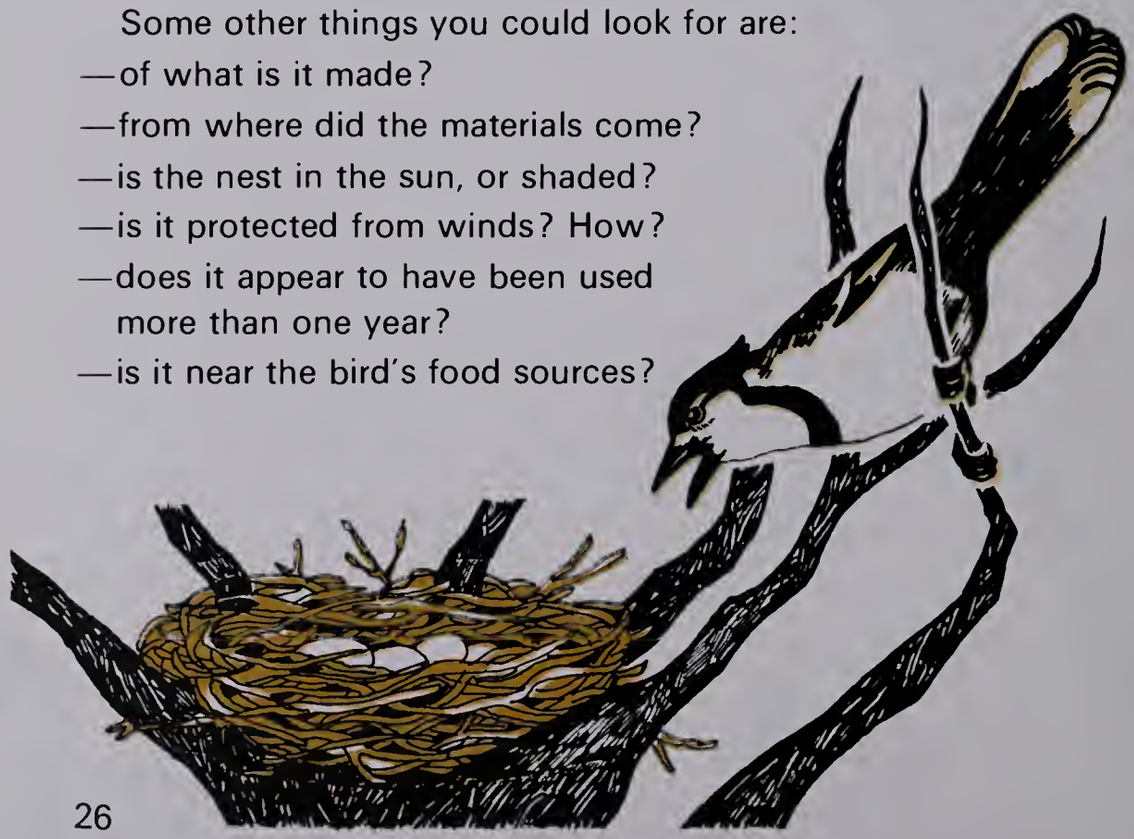
METHOD

Look carefully for bird nests. The ground, shrubs, and low trees are good places to begin. Often the edge of the woods will be the home of many birds. It is easy to see nests in trees with no leaves.

When you find a nest, make a drawing to show its shape, where it was built, its size, and the materials used. Never touch the nests.

Some other things you could look for are:

—of what is it made?
—from where did the materials come?
—is the nest in the sun, or shaded?
—is it protected from winds? How?
—does it appear to have been used more than one year?
—is it near the bird's food sources?



—how did the bird try to hide the nest from other animals?
—did some of the materials come from outside the forest? Which ones?
—did the bird need special beak or foot features to build the nest?
—in which forest level is the nest? Does the bird feed in the same level?

Activity 2: BIRD FOODS

What do birds eat? The woods provide many kinds of foods. In some places it is more plentiful than others. In this activity, you will try to find birds' foods.

METHOD

Make a list of things in woods that birds could eat. Note signs you find that birds have been eating. You might organize the records like this.

FOOD FROM PLANTS

	food	birds using this food	signs of use	location
liquid				
solid				

FOOD FROM ANIMALS

dead				
living				

Keep this record with you when doing other activities so that you can add to it whenever you see a new food source or new signs of bird feeding.

You may want to record other items such as the approximate size of the bird. (See the companion book *Studying Birds* for a guide and the types of adaptations the birds have to eat their food.)

What is the importance of food to birds?

Which food, if any, came from outside the forest?

Which did you find more often: birds feeding or signs that they had been feeding?

Other Activities

1. Write a story describing from a bird's point of view, the problems of finding food for its young. Mention things you have seen.
2. Build a bird feeder so that you can find out the foods birds like.
3. Watch birds in their nests. How do the parents feed the young? How many young are there? What do they eat? How often? How are the eggs cared for?
4. Compare the nest materials of woodland birds with the materials in nests of field birds.
5. Pick an interesting group of birds, for example the warblers. Read about their habits, where you might expect to find them, what they look like, and then try to observe some.
6. Show that all the food which birds eat was first produced by green plants.

See the companion book *Studying Birds* for many hints on the study of birds.

Insects

Insects are the most numerous and easily found animals in the woods. They are everywhere. In this section we shall first consider some methods of finding and collecting insects. Then there are some suggestions for learning to recognize kinds of insects.

Activity 1:
INSECTS ON THE WOODLAND FLOOR

MATERIALS

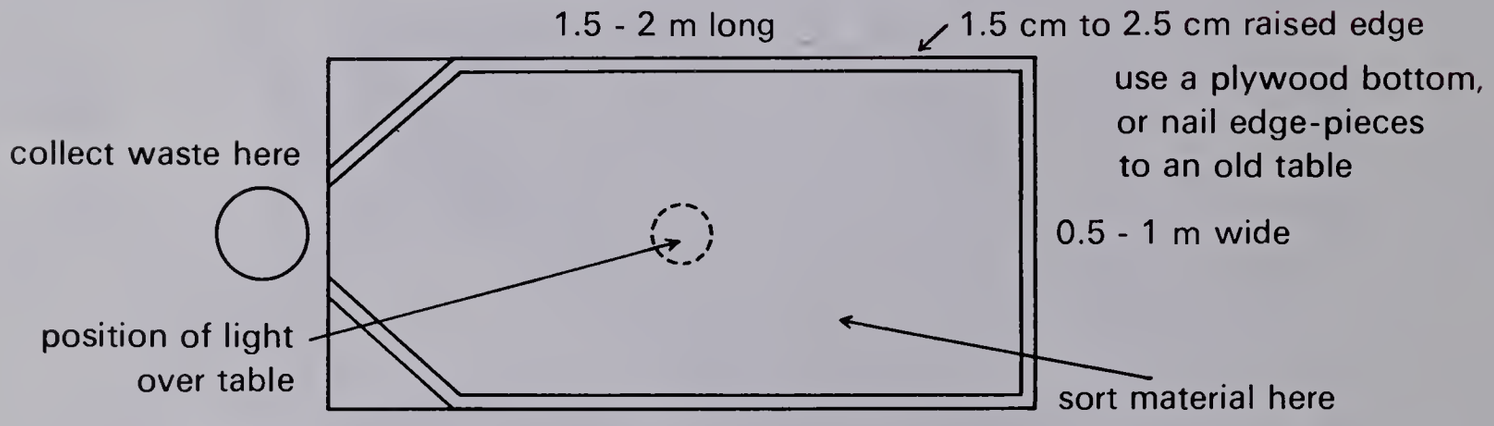
A garbage bag full of litter from the woodland floor, moss, or other loose humid material.

A large flat table, light-coloured or covered with a light-coloured material such as oilcloth.

Waste container.

A 100 W light hung about 20 to 25 cm above the table.

Here is a suitable sorting table.


1.5 - 2 m long
1.5 cm to 2.5 cm raised edge
use a plywood bottom, or nail edge-pieces to an old table
collect waste here
0.5 - 1 m wide
position of light over table
sort material here

Hang the light over the middle of the table. Six to eight pupils can work around a table this size.

METHOD

1. Prepare the sorting table, including the light.
2. Collect material from the forest. This may be stored in a cool place for up to two weeks if it is not allowed to dry. Collecting can be done in the winter just as satisfactorily as at any other time.

3. Spread some of the material on the table.
4. Watch closely for animals moving. Some will be very small and move slowly. Animals often move away from the light.
5. Slide sorted material through the opening into a waste container.
6. Once you have about a dozen insects you might be able to group them. Activity 3 suggests some ways this could be done.
7. When you have sorted, studied, and grouped the insects they should be put back in the litter material and returned to where you found them. You may wish to preserve some for a class collection.

Many of the animals will not be insects. How will you be able to recognize those that are insects?

What kinds of materials had the most insects?

What was the most common kind of insect found in each of the different materials you used? Why?

Another technique for finding insects is given on page 61.

The Fly

How large unto the tiny fly
Must little things appear!—
A rosebud like a feather bed,
Its prickle like a spear;

A dewdrop like a looking-glass,
A hair like golden wire;
The smallest grain of mustard-seed
As fierce as coals of fire;

A loaf of bread, a lofty hill;
A wasp, a cruel leopard;
And specks of salt as bright to see
As lambkins to a shepherd.

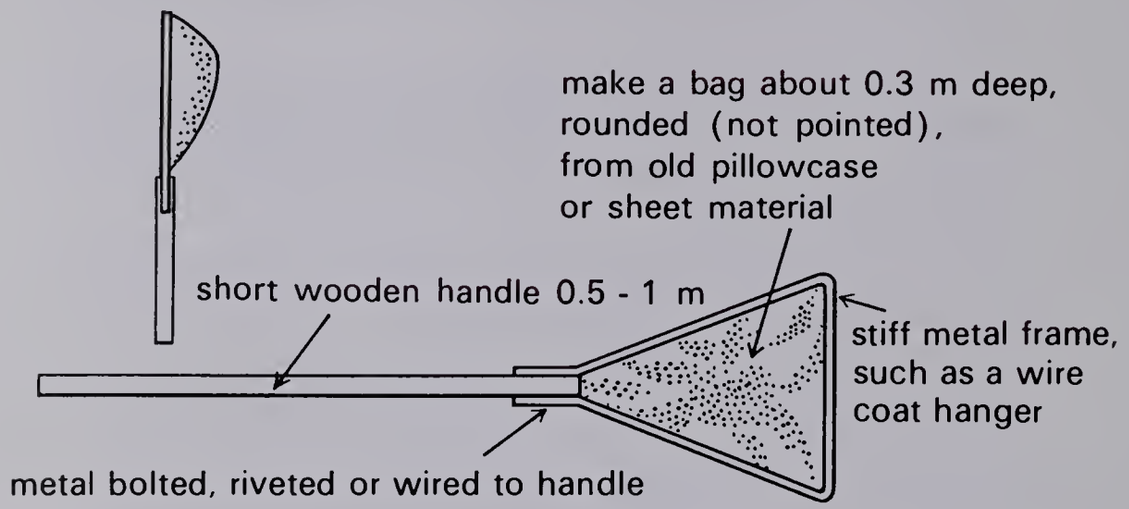
Walter de la Mare

Activity 2:
INSECTS ON PLANTS

In this activity you will learn a few ways to catch insects that are not flying.

METHOD 1 Sweeping

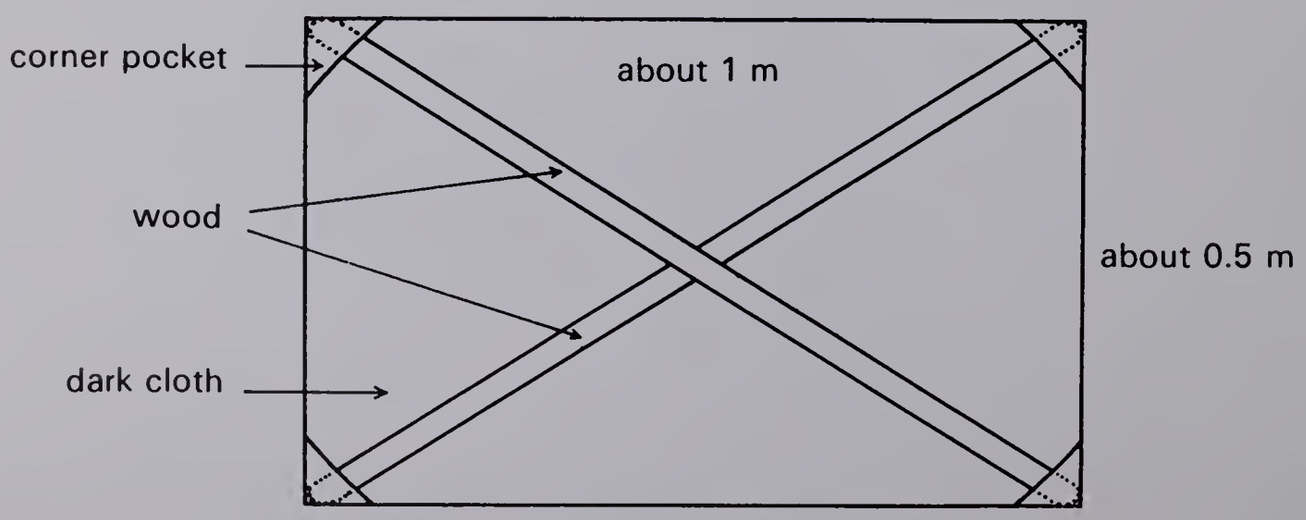
1. Make a net like this.


make a bag about 0.3 m deep, rounded (not pointed), from old pillowcase or sheet material
short wooden handle 0.5 - 1 m
stiff metal frame, such as a wire coat hanger
metal bolted, riveted or wired to handle

2. Sweep the net through grass, low plants, and light shrubbery.
3. Collect the insects which are swept into the net. Do not use the net in water, or as a butterfly net.

METHOD 2 Beating

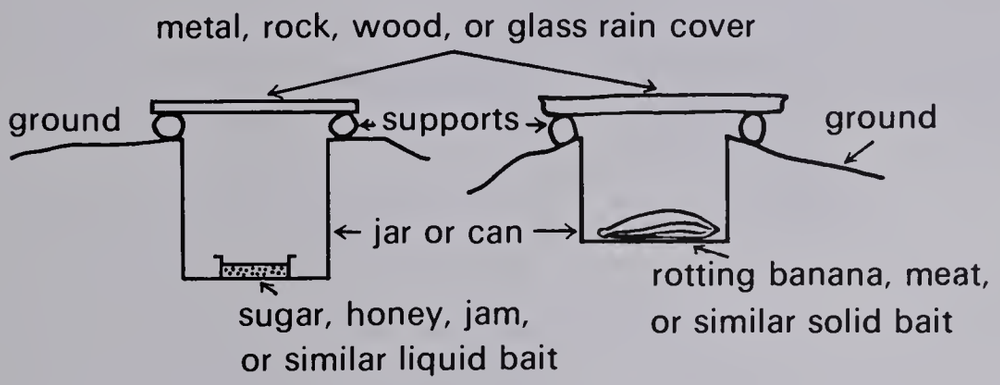
1. You will need an old sheet, newspaper, or an umbrella. A folding sheet and frame of this design can be easily stored and carried. A dark colour is best.



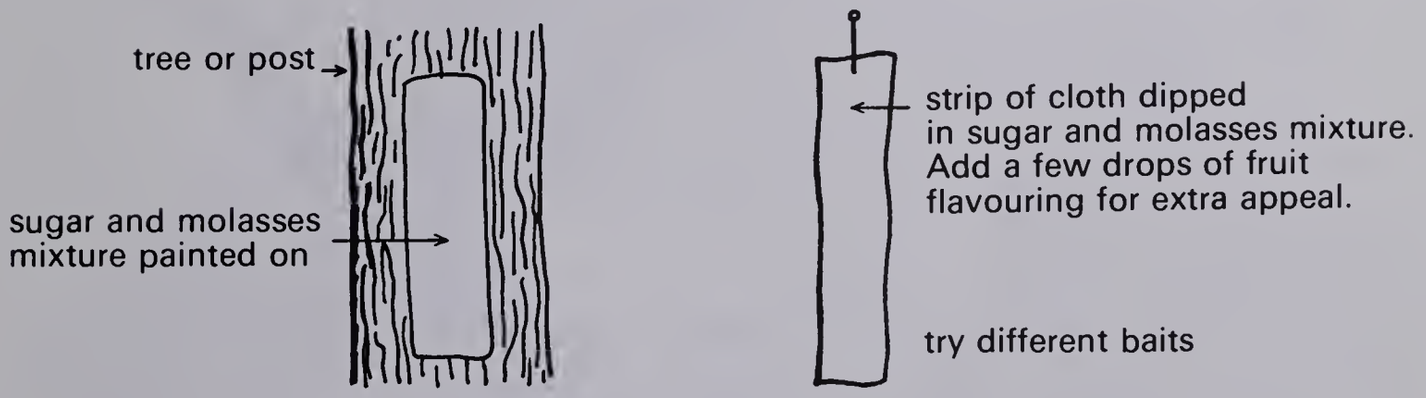
2. The sheet is held under the shrub or tree from which the insects are to be collected.
3. Beat the branches with a stick. Do not damage the branches.
4. The insects and other animals will fall onto the sheet.
5. Collect and sort the animals you want.

METHOD 3 Baiting and trapping

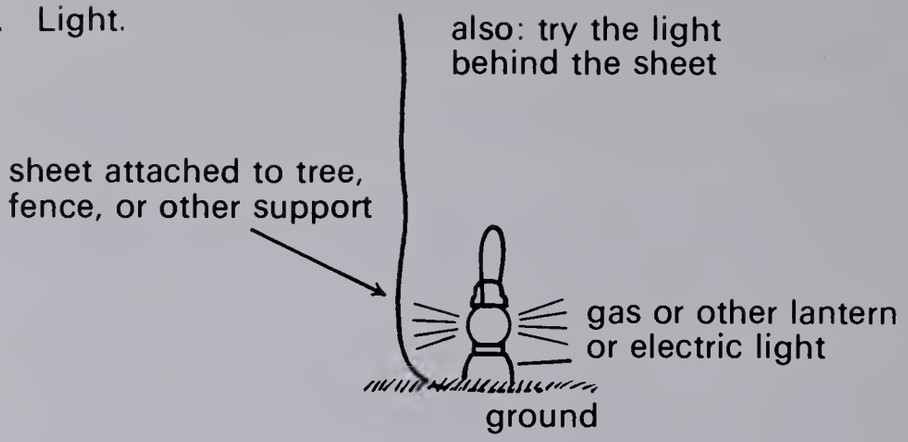
1. Use pitfall traps.

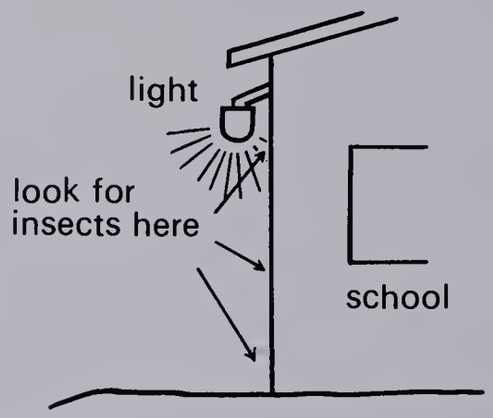


2. Bait.



3. Light.





Activity 3:
KINDS OF INSECTS

Scientists group animals so that all the ones with certain characteristics are in the same group. All insects have one certain characteristic. What is it?

By now you know that there are many kinds of insects. In this activity you will try to group them.

METHOD

1. You will need 30 to 40 insects.
2. Pick a characteristic that you think will help to tell the insects apart. Colour, means of moving, and number of wings are suggestions. Many others are possible.

carpenter ant

fall webworm moth

grasshopper

dragonfly

lady bug

Other Activities

1. Have your teacher help you find out what characteristics scientists use to group, or classify, insects. Also check the book, *Studying Insects*.
2. Take equal volumes of forest soil material from different places and carefully sort out the insects. Compare the populations you find. Are there differences? Why?
3. Use different coloured lights to attract insects. Which seem to be most effective? Other factors, like temperature, height above ground and brightness, should be kept unchanged.
4. Compare forest insects with field insects.
5. How many different kinds of insects can you find in and on a dead log, or a particular kind of plant, or a piece of meat set out for a few days?
6. Watch for and study the early stages of insects.
7. Try to recognize insect "music". Use records of animal sounds to help you become more familiar with them.
8. Write poems or stories on the activities of insects.
9. Sketch an attractive display showing common insects in their natural setting and with their natural food. Include immature stages if possible.
10. Watch one kind of insect closely to become familiar with its behaviour. For example: What does it eat? What eats it? How does it eat, move, make noises, reproduce? What do its young look like? Observe insects in the classroom.
11. The collecting methods will all catch many animals that are not insects. A whole new world of animals is opened up here.

Mammals

Mammals are a large group of animals. They too have certain characteristics that other groups do not have.

What are the two special characteristics of mammals?

Some woodland mammals have masses of only a few grams and others are over 500 kg. What are some mammals you might find in a wood?

In those activities you will look for signs that mammals are in the area. When you have done these well you should be able to make good observations of any mammal you see.

Activity 1: LOOKING FOR SIGNS OF MAMMALS

This activity will help you to find and study the different signs that mammals leave as they live in an area. If you wish to find out what kind of mammal made the sign you will need good reference books and experience. The *Studying Mammals* companion book will help.

MATERIALS

Notebook, pencil and ruler

METHOD

1. Pick a small section of woods to investigate carefully, or take a slow, careful walk through different parts of the woods.
2. Watch for the signs listed here.

TRACKS. Mammals walking on mud, snow, wet ground, and wet sand make the best prints.

—How long is each footprint? How wide?
—How far apart are the prints?
—How many toes show?
—Do claw marks show?
—How deep is the print?
—Does the foot appear to have pads?
—Do the prints overlap?
—Was the animal walking or running?
—Are there webs between the toes?
—How old do the prints seem to be?

Make an accurate diagram of a recent pair of prints.

One of the best ways to learn about tracks is to follow a cat or dog while it walks and runs. Bring one to class so that you can study its tracks. It might leave some other signs as well.

HAIR TUFTS. Look on bushes, fences, and other places where mammals may have passed.

FEEDING MARKS. Look for seeds, nuts, cones, bushes, leaves, tender shoots, tender bark, and plants which show teeth marks or other signs of feeding. Sketch the signs.

Can you tell from the height of the marks, the size of the teeth, or in other ways what animal might have made the marks?

NESTS. Mice and voles make nests in grassy areas, in hedges, and in shrubbery. Squirrels nest in trees. Winter is a good time to see these. They are usually not as neatly made as birds' nests.

BEDDING MARKS. Deer in winter leave depressions in the snow when they lie down. You may find one or several of these where cover is good. Swamp shrubbery is a good place to look.

TUNNELS. Mice and voles make tunnels in the snow. You may see these as the snow melts. Tunnels may be found at other times in grassy areas and along hedges.

DROPPINGS. Mice, voles, rabbits, deer, and moose are some of the mammals whose droppings (scats) may be found. These give clues to the kinds and numbers of animals in the woods.

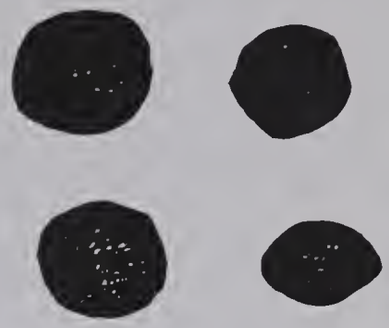
Place pieces of plywood on the ground. Put on them bits of sandwiches and meat to attract night visitors. Many will leave scats on or near the wood.

Make accurate measurements and diagrams. Good observations will enable you to identify the animal.

MAMMAL SCATS

white-tailed deer

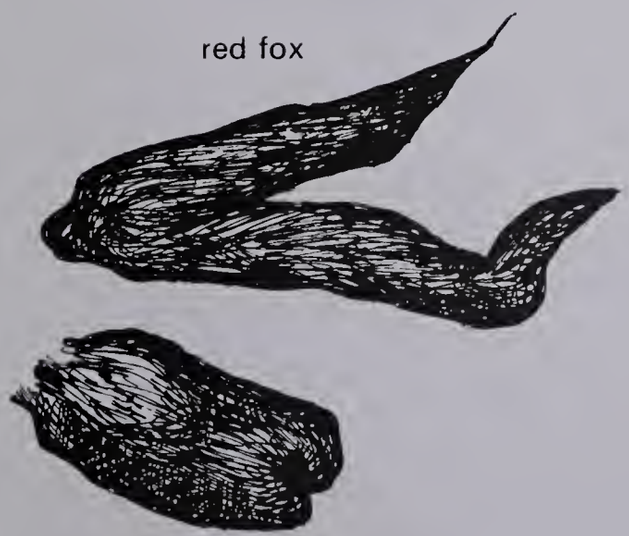
cotton tail rabbit



black bear

grey squirrel

red fox



raccoon

Activity 2:
WATCHING AND RECORDING

You are more likely to see the signs of mammals than the mammals themselves. When you do see a mammal, these questions may help you to make observations which will tell many things about its life.

METHOD

Watch the same kind of animal often and make notes.

HABITAT. Where did you see it? What kind of plants was it in or near? Were other animals nearby? Was it a rocky area? Flat? Shaded? Open? Hilly?

APPEARANCE. What did it look like? Was it young or adult? What size was it? What colour?

CONDITIONS. What season, date, and time was it seen? What were the weather conditions?

NUMBER. How many were seen?

BEHAVIOUR. Was it eating? What food? How did it move? How fast did it move? If it was mating, how did it mate? Was it with its young? How did it look after them? What sounds did it make?

Activity 3:
SQUIRRELS

You can study these common woodland animals using the techniques you have learned in the first two activities.

MATERIALS

Binoculars, if possible. Notebook and pencil
Ruler

METHOD

1. Find a place where from your earlier observations you know that squirrels are seen fairly often.

2. Look for some of the signs mentioned in Activity 1. Record as much information as you can. Make diagrams where possible.
3. Use Activity 2 as a guide when you see the animals.
4. Observe the animals throughout a full year.
5. Use dead and preserved animals to assist your observations of living mammals.

The Squirrel's Nest

One day, when all the woods were bare and blea,
I wandered out to take a pleasant walk
And saw a strange-formed nest on stoven tree
Where startled pigeon buzzed from bouncing hawk.
I wondered strangely what the nest could be
And thought besure it was some foreign bird,
So up I scrambled in the highest glee,
And my heart jumped at every thing that stirred.
'Twas oval-shaped; strange wonder filled my breast;
I hoped to catch the old one on her nest
When something bolted out—I turned to see—
And a brown squirrel pattered up the tree.
'Twas lined with moss and leaves, compact and strong;
I sluthered down and wondering went along.

John Clare

Was the person in the poem behaving as a good naturalist should behave?

Other Activities

1. Use Activity 2 to study other animals, for example snakes.
2. Make plaster casts of tracks.
3. Set a tent or blind near an animal's home. Hide in it often and observe the animal regularly. Write an article on the life of your "friend".

Plants

The forest is plants, many kinds of plants. Some are small, and have no roots or stems or leaves. Some are large; some are very large. Some produce flowers and seeds. Some do not. Most need soil; some do not.

You will begin to meet the big, fascinating world of plants in these activities.

Activity 1:
PLANT SUCCESSION ON A STUMP

Plants in an area have not always been the same. In many places the plants that we see growing now have followed different kinds of plants. If trees grow where grass used to grow, we say that the trees *succeeded* the grass.

Generally, one kind of plant may prepare the environment so that another kind of plant begins to grow there. We say this is an example of *plant succession*. Eventually the second plant may replace the first. The first plant used to be dominant, then the second plant is dominant.

Give a dictionary definition of: succeed, succession, plant succession, dominate.

What are some ways in which early plants prepare the way for later kinds of plants? Examples of plant succession may be seen in the woodlands. The following activity will help you to investigate one of them.

MATERIALS

Ruler
Nail
Notebook and pencil
Hand lens

METHOD

1. Find out what lichens (pronounced likenz) look like. You will need to place plants into five groups: lichens, mosses, ferns, small flowering plants, and trees.
2. Look for a tree stump that is covered with plants. If you cannot find a stump, then a fallen log or a rock covered with plants will do. If there are some places on the stump where no plants are growing, your study will be more complete.
3. Find a place on the stump where there are no plants. Press the nail into the wood. Then press the nail into a live tree. Do you notice any difference? Can you explain any difference?
4. Press the nail into a part of the stump where plants are growing. Is this press different from the other two? Explain.
5. Examine the plants on the stump. Are lichens growing there? Mosses? Ferns? Little flowering plants? Small trees? Which kind of plant seems to grow in the least

jewel weed
fringed gentian
white water lily
pickerel weed
bloodroot
violet
trillium

soil? In the most soil? Do any grow without soil? DO NOT DESTROY OR SERIOUSLY HARM THE PLANTS DURING THIS EXAMINATION. Which kinds of plants, if any, are less than 1 cm tall? Between 1 cm and 2 cm tall? Between 2 cm and 5 cm tall? Between 5 cm and 15 cm tall? Over 15 cm tall?

6. What other differences are there among the kinds of plants?
7. Make a diagram to show the stump with the various kinds of plants on it.
   Which kind of plant do you think is the most complex? What evidence do you have to support your answer?
8. Look for places on the stump where only one kind of plant is growing. What is it?
   Which kind of plant do you think grew earliest on the stump? Give reasons for your answer.
9. Which kind of plant seems to have been the last to start growing? Give reasons for your answer.

How do you think that the first plants on the stump prepared the way for other plants to grow? What evidence do you have?

Do your observations on the stump support the definition of plant succession given at the beginning?

What do you think will be the next stage in the life on the stump? Why?

Activity 2:
TREES THROUGH THE YEAR

This is a continuing study to help you see better what trees do during a year. You can begin anytime. Choose, perhaps, a day in September as your tree's "birthday".

For one year, until the tree's next "birthday", make regular visits. Your notes will be like a diary.

A deciduous tree may show more changes in one year

than an evergreen. Study one of each kind, or be part of a team which studies both kinds.

MATERIALS

Notebook and pencil
Ruler. Hand lens
Plastic collecting bags (at times)

METHOD

1. Choose a tree near your home or school which you can visit easily. Pick one with some branches low enough for you to reach at least the ends.
2. Using the questions following the chart as a guide, make regular careful observations of changes in the bark, branches and twigs, leaves, flowers (when present), fruit (when present) and buds (on twigs).
3. Use diagrams often. Measure everything possible. Accurate and complete records will help you to make better and more accurate comparisons over the year. Always date observations.

Summarizing the year

A chart like this might help you to follow the events.
Also include entries for related factors, for instance:

(a) where the tree is (north-facing slope, south-facing slope, swamp).
(b) creatures attracted to it.
(c) the weather on each occasion.

TREE: Tim Edwards

DATE	BARK	TWIG	BUDS	FLOWERS	LEAVES	OTHER
SEPT. 12 – SEPT. 26, 19– –	GREY, GREEN SPOTS, RIDGED	REDDISH-BROWN, WHITE SPOTS	SMALL, BROWN, SOME STICKY	NONE	TOOTHED	SOME BRANCHES ARE BLACK
SEPT. 27 – OCT. 25, 19– –						
OCT. 12 – OCT. 25, 19– –						
OCT. 26 – NOV. 9, 19– –						

Late summer

What is the bark like? Are any animals or plants on it? Is the base moist?

What is the shape, vein pattern, and colour of the leaves?

What do the last 30 cm of a twig look like? Do you see buds on the twigs? Draw the twig and identify the parts.

Mark a line (see Activity 3) on the twig a fixed distance, for example 15 cm, from the end. Use this to measure changes in the length of the twig.

Are there seeds or fruit on the tree? Where? How are they attached? What do they look like? What signs are there of any flowers that were on the tree?

Fall

What changes occur in the twigs? leaves? and buds?

What happens to the fruit as the weeks pass by?

How much has the twig grown?

When do the leaves fall? Do they all fall at the same time? Was there a colour change? Did anything seem to cause a colour change? Do some leaves stay on all winter? If so, why?

Winter

What does the twig look like now? Draw an accurate diagram. Compare it to the one you made earlier. What changes do you note?

What changes occur in the buds as the winter passes?

What is inside the different kinds of buds?

Draw a diagram of the scar where a leaf was attached to the twig.

Spring

What changes occur in the bark? the twig? the buds?

When do the flowers show? Draw them. Are there two kinds? Do all the trees of the kind you are studying have the same type of flowers? If there are staminate and pistillate flowers, make diagrams of each.

Is the pistil sticky? Is nectar produced? Are the petals coloured attractively?

Can you find the stamens? Are they making pollen? Observe the pollen under a microscope. Draw it.

Do you see insects around the flowers? Is the tree wind-pollinated or insect-pollinated?

What changes occur in the flowers as the days go by? Frequent visits are best at this time of year.

How much has the twig grown?

Early summer

Are there any buds that have not opened?

What different kinds of buds did your tree have?

How can you tell what part of the twig is new growth?

What does the bark look like? What changes have occurred since you started to observe it?

What differences do you note between the new leaves and the ones you observed last fall?

What changes are occurring in the flower? What developments are leading to the fruit stage? Frequent diagrams of the pistil are recommended.

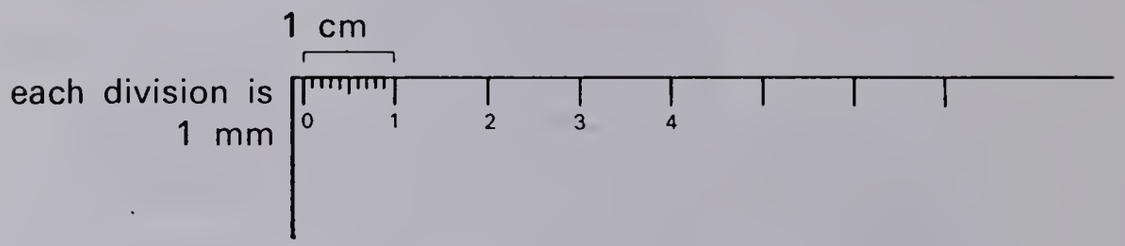
Activity 3:
HOW FAST DO TWIGS GROW?

You know that some trees lose their leaves in winter. They seem to be dead. Then new leaves appear and the tree grows. Have you ever wondered if trees grow all their life? Do they grow at all in the winter? Do they grow fastest in the summer? Do they grow fastest in the spring? Do they grow at the same rate all the year?

This experiment will help you to measure a tree's growth. Then you may find the answers to these and other questions.

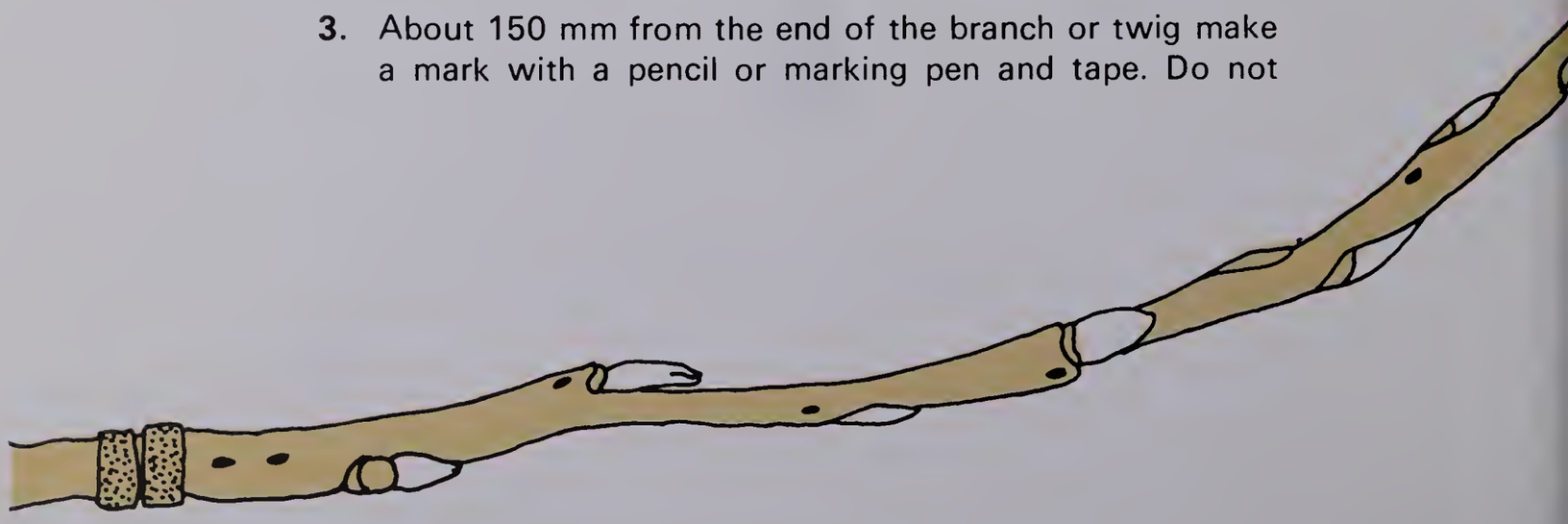
MATERIALS

A ruler marked with millimetres
Marking pen, masking or adhesive tape
Pencil and notebook



METHOD

1. Pick a deciduous tree near your home or school. This is best done some time before the end of winter. The end of February or early March is suitable in most places. It should be a tree that you can visit often.
2. Find a healthy branch that you can reach easily.
3. About 150 mm from the end of the branch or twig make a mark with a pencil or marking pen and tape. Do not



damage the twig but make the mark clear enough to last several months.

4. Make a chart like this in your notebook:

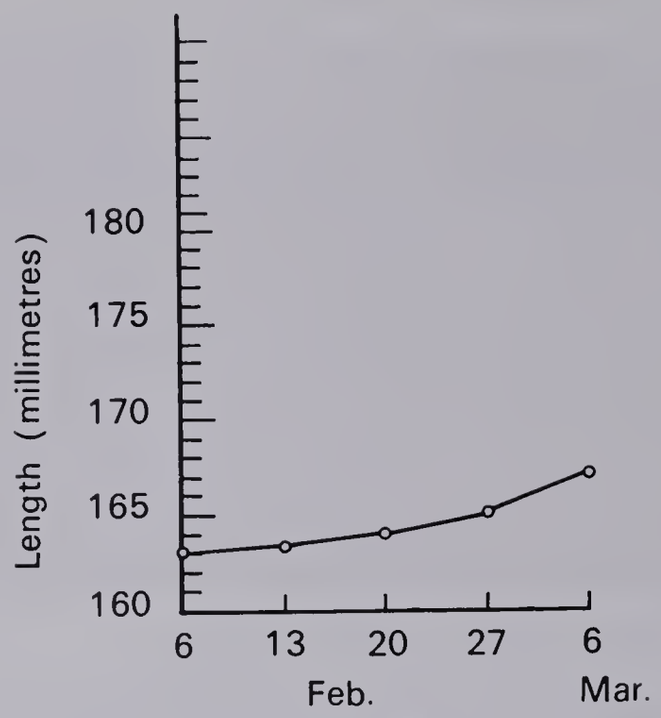
OBSERVATION NUMBER	DATE	LENGTH	INCREASE IN LENGTH
1			
2			
3			
4			

Allow space for about 20 observations.

5. Once a week measure the distance from the mark to the end of the twig. Record this on the chart. Measure in millimeters. Do not include any leaves as part of the length of the stem.

OBSERVATION NUMBER	DATE	LENGTH	INCREASE IN LENGTH
1	FEB. 6	163 MM	—
2	13	163	0 MM.
3	20	164	1
4	27	165	1
5	MAR. 6	167	2

6. Make a graph of the results.



You have made a graph by plotting the *length of the twig* against the *date* on which the measurement was made. You have a picture of the growth of the twig for several months. If you wished to make observations for a year you could learn more about tree growth. From the graph, answer these questions.

1. When did the twig start to grow after the winter leafless condition?
2. When did the twig grow slowest?
3. Which week did it grow fastest?
4. Did the twig stop growing while you observed it? If so when?

Other Activities

1. Investigate the decay of trees.
2. Study animals on decaying stumps.
3. Learn about lichens.
4. How do ferns reproduce?
5. Set up a woodland terrarium to resemble the little community on the stump.
6. Find out why certain plants usually are early in a succession and others are generally later.
7. Look for other examples of plant growth where one or several kinds of plants make the environment suitable for other plants to grow.
8. Find an area that has been burned over recently. What plants seem to be the first to grow there? What special features might they have that enable them to do this?
9. Study in more detail some of the plants you find on the stump.
10. Look for stumps and logs in different stages of succession.
11. Compare evergreen and deciduous trees.
12. Try to make twigs flower indoors.
13. Study different kinds of flowers, fruits, seeds, leaves, etc.
14. Identify trees from their leaves, and from their twigs in winter.
15. Learn about bark, wood, and cork.
16. Study pollination.
17. Classify plants and trees in the way you did in Activity 3 of the Insects section.
18. In mathematics class, your teacher can help you to work out several ways to estimate the height of a tree. For a start, how many people of your height would have to stand on each other's head to reach the top of the tree? Triangle measurements can also be used.

Birch Trees

The night is white,
The moon is high,
The birch trees lean
Against the sky.

The cruel winds
Have blown away
Each little leaf
Of silver gray.

O lonely trees
As white as wool . . .
That moonlight makes
So beautiful.

John Richard Moreland

Soil

The soil, as you may have seen in your first look at the woods, is a very important part of a natural community. Some plants grow in one kind of soil but not in another. Some soils support very little life; others provide essentials for a large number of plants and animals.

There is much to learn about soils. In these activities we shall take a look at three different features of a forest soil. First, some of the animals living in it are examined. Second is a test of the soil for one of its hidden chemical characteristics. Third, the appearance of the soil at different depths is studied.

Activity 1: INVERTEBRATES IN THE SOIL

Many features of soil are difficult to see without special care. You might not notice them without assistance. Small animals in the soil are like this. Except for large animals like earthworms, you might almost not know that there are any in the soil. Let us find and observe some.

First, find out what an invertebrate animal is.

MATERIALS

Collecting funnel described on the opposite page.

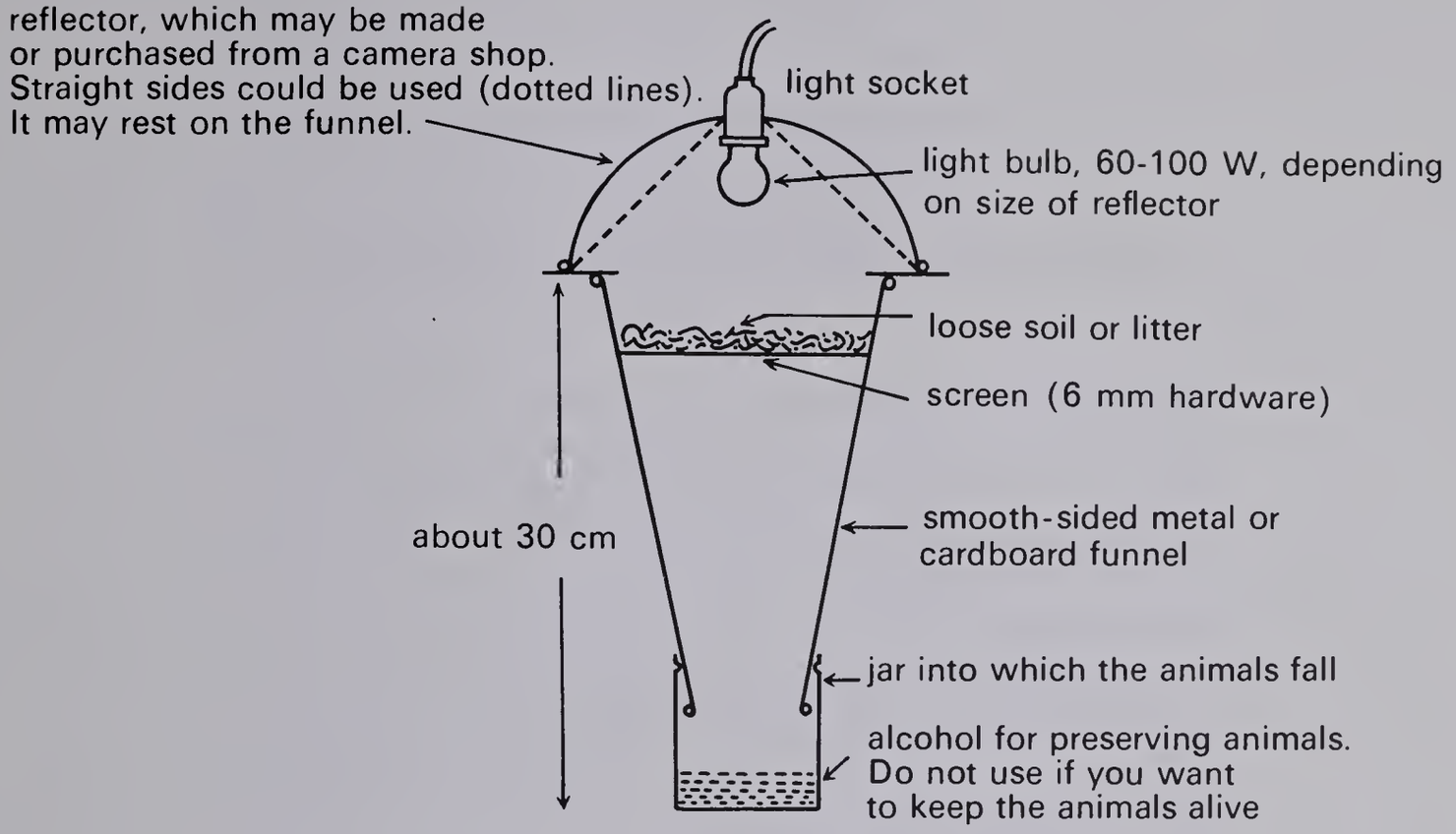
Small clear plastic bottles for preserving animals

Alcohol (a preserving fluid)

Bags of loose soil and litter

METHOD

1. Make the apparatus shown here.


reflector, which may be made
or purchased from a camera shop.
Straight sides could be used (dotted lines).
It may rest on the funnel.
light socket
light bulb, 60-100 W, depending
on size of reflector
loose soil or litter
screen (6 mm hardware)
about 30 cm
smooth-sided metal or
cardboard funnel
jar into which the animals fall
alcohol for preserving animals.
Do not use if you want
to keep the animals alive

2. Collect the top material of the soil and the litter just above it. These will often contain many small invertebrate animals. Plastic bags are good for collecting material in. Store the material in a cool place and use it within 10 d or two weeks.
3. Put a small amount of material on the screen, then place the light over it, and the jar under the funnel. If you need dead insects for further study, put some alcohol into the jar to kill the animals which fall in.
4. The light and heat make the animals move. Usually they fall through the screen and slide down the funnel into the bottle. Thirty minutes to a few hours should be enough to remove the organisms from most samples.

What kinds of insects do you find? Do they fit into the groups you made in Activity 3 of the Insect studies? What new groups seem to be needed?

Divide the invertebrates you find into groups (see Insects, Activity 3, for ideas).

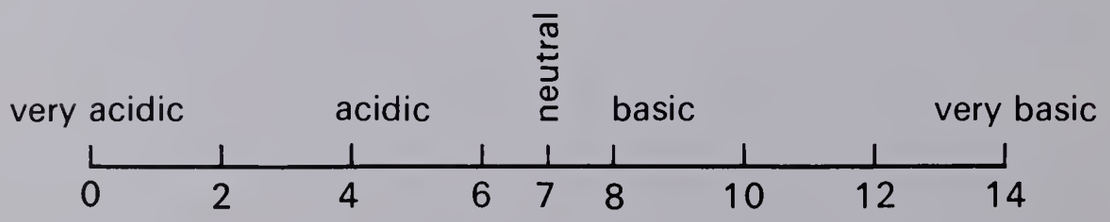
Preserve some in bottles for special studies.

Activity 2: SIMPLE MEASUREMENT OF SOIL ACIDITY

Plants must obtain many nutrients (foods) from the soil. So soil is very important. A necessary ingredient for plants is calcium. You cannot see whether a soil has enough calcium in it for a certain kind of plant, but you can test in special ways to find out. Like you, plants get sick if they have too much, or not enough, of a food.

The test in this activity is a chemical test. It will tell you whether the soil is acidic or basic. Plants which grow well on basic soils are often much different from those which grow well on acidic soils. It is important to be able to tell acidic soils from basic soils.

Acidity is measured on a scale from 1 to 14. We will use chemicals which change colour. Litmus, for example, is blue



in basic (above 7) soil and red in acidic (below 7) soil. The 1 to 14 scale is called the pH scale. The numbers are pH numbers. 7 indicates a neutral (neither acid nor base) soil.

MATERIALS

Small test tube White paper

Acid-base indicator solution. Bromthymol blue which is used to test aquaria water for pH is satisfactory. It indicates in the range pH 5.0 to pH 7.6. Other indicators may be used if other ranges are desired.

Soil samples

METHOD

1. Thoroughly clean and rinse the test tube.
2. Put a small sample of soil, about the amount of two peas, in the bottom of the test tube.
3. Pour bromthymol blue, or other indicator, onto the soil until there is about twice as much indicator as soil.
4. Mix the soil and indicator by shaking the tube.
5. Let the mixture settle.
6. Hold the tube, now with solution in it, against a piece of white paper.
7. Compare the colour of the solution with the colour chart supplied with the indicator. Estimate the acidity or basicity of the soil.

For bromthymol blue indicator:

yellow indicates acid, approximately		pH 5
green-yellow	slightly acid	pH 6
green	neutral	pH 7
blue	slightly base	pH 8

Activity 3:
WOODLAND SOILS

The soils in woodlands have features which can be seen at road cuts, eroded stream banks, in holes, and at other exposed places. A study of the top few feet of the soil can reveal many new things about the soil.

MATERIALS

Hand lens, shovel or trowel

Hydrochloric acid (most steam-iron cleaning solutions are dilute hydrochloric acid)

Sketch book and pencil. Small plastic sample bags

METHOD

1. Find a suitable place for observing, where possible, at least the top 0.5 to 1 m of soil. If a suitable cut or bank cannot be found you may need to dig a hole. In any case dig with a shovel to expose fresh soil.
2. Examine the soil carefully. Consider: Does the soil seem to be formed in layers? How many? Carefully measure the thickness of any layers. What colours of soil are there? Is the soil sandy?; clayey?; stony? Are all parts of the soil the same? What differences, if any, do you see? Is there humus (dead plant and animal material) in the soil? Is the soil wet?; dry?; moist? Is the moistness the same in all parts?
3. If you have a bottle of *dilute* hydrochloric acid, use an eye dropper to apply some to the soil at different levels. What do you observe? What kind of substances fizz when hydrochloric acid is applied to them? How could you explain any fizzing? What does no reaction indicate? Where does each usually occur?
4. Make a scale diagram of the layers of the soil. Describe in point form on the diagram the features of each layer. Collect small samples of the material in each layer and mount them beside that layer on the diagram.

Other Activities

1. Study some of the animals you found in the soil.
2. Compare the kinds and numbers of animals in soils from different places.
3. Begin a collection of the animals in soil near your school.
4. Compare the pH of many different soils.
5. What effect does the pH of the soil seem to have on the kinds of plants which grow in it?
6. Compare soils from different kinds of woods—birch, pine, cedar swamps, and others.

7. Compare soils at the top of a hill, part way down, and at the bottom.
8. Find out what kinds of plants grow best in acidic soils. Which kinds grow best in basic soils? Do most plants grow in soils that are approximately neutral? What might be some reasons for plants growing best in certain kinds of soils?

Streams

Streams are the homes for many interesting kinds of plants and animals. Some are big. Some are small and you need microscopes or hand lenses to see them.

The streams in open places are much like those in woods. Other books in this series, *Studies for Open Places* and the companion book *Studying Streams*, describe further activities you can do.

Activity 1: GENERAL INSPECTION

MATERIALS

Notebook and pencil Hand lens
Measuring tape or stick

METHOD

1. Draw a map of part of a stream. Show rocks, logs, trees, and other obstacles or hiding places in and around the stream.
2. Examine the stream carefully. Use the hand lens often.

These questions will help you start. Soon you will see many other things to study and watch.

Where is the stream deepest? Where is it shallowest? Are these places in any way related to the width of the stream? Is the material on the bottom the same in both places? Mark the places on the map.

Where is the fastest part of the stream? The slowest? Are these places related to the width of the stream in any way? Is the material on the bottom the same in both places? What is the material on the bottom in each of the places? Mark your map.

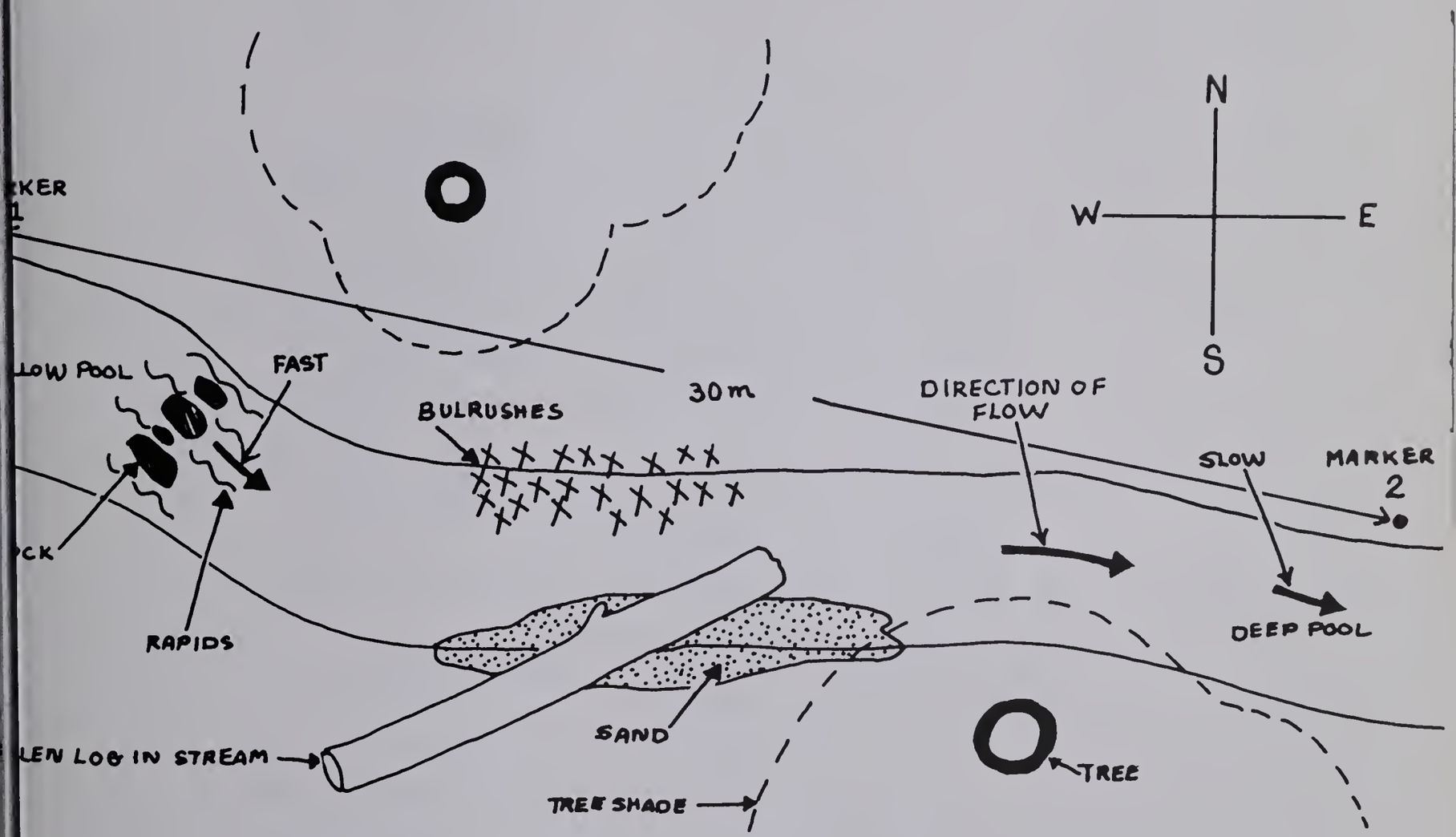
What parts of the stream are shaded for all or most of the day? What effect does this have on the stream? Show shaded areas on the map.

What effect do obstacles have on the water flow? What effect is there on the depth of the water and the bottom material?

Is the stream bank cut away? Where? What seems to have caused this? Where has the material of the bank been deposited?

Are there any little rapids or waterfalls? What is the bottom like in these areas?

Also study other interesting places such as spots where bulrushes grow, and pools. Indicate them on the map. Muddy places are often fascinating.



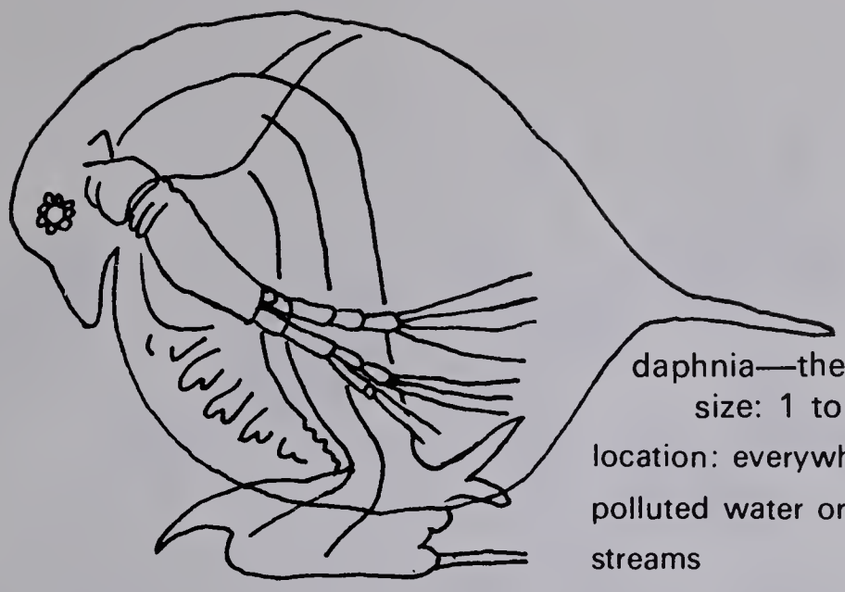
Activity 2:
WOODLAND STREAM BOTTOMS

MATERIALS

Notebook and pencil Jars, for collecting
Kitchen sieves or strainers Hand lenses
Bowls, dishpans, or similar pans for sorting material. These should be white.

METHOD

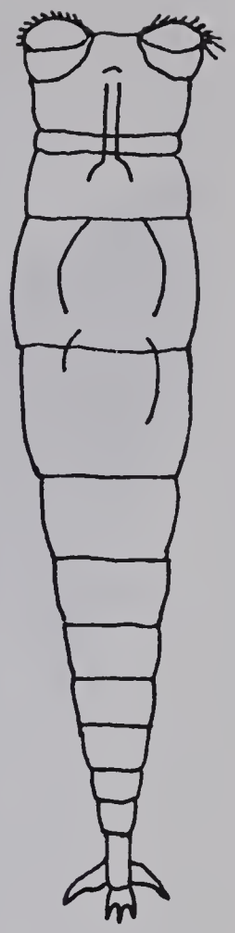
1. Select a part of the stream for study. Perhaps one of the areas found in Activity 1 seems to be worth further investigation. A few sievesful of the bottom can provide much material to examine.
2. Put some of the material into a tray and spread it out. What kind of material did you find? Are there animals in the material? Look closely for very small ones.
3. Are there plants and animals living on the rocks on the bottom? Do they seem to prefer the top or the bottom of the rock? What might they eat? Does anything eat them? Do rocks in one part of the stream seem to have more growth on them than the rocks on other parts of the stream? Why? Where?
4. Why do some areas of the stream have sandy bottoms, some silty, some clayey, and some rocky? Can you find all of these types of bottoms?
5. What can you find on the bottom of the stream that could only have come from the woodland?
6. Poke around in the stream for things that seem to be worth looking at more closely.



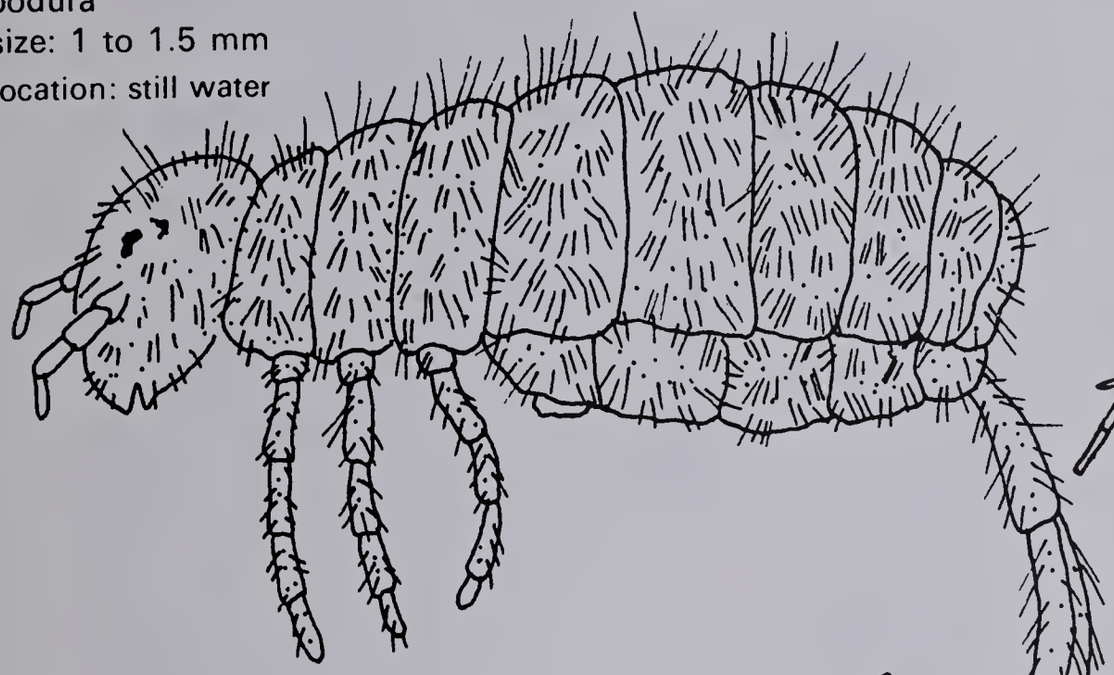
daphnia—the water flea
size: 1 to 4 mm
location: everywhere, except in polluted water or in fast moving streams

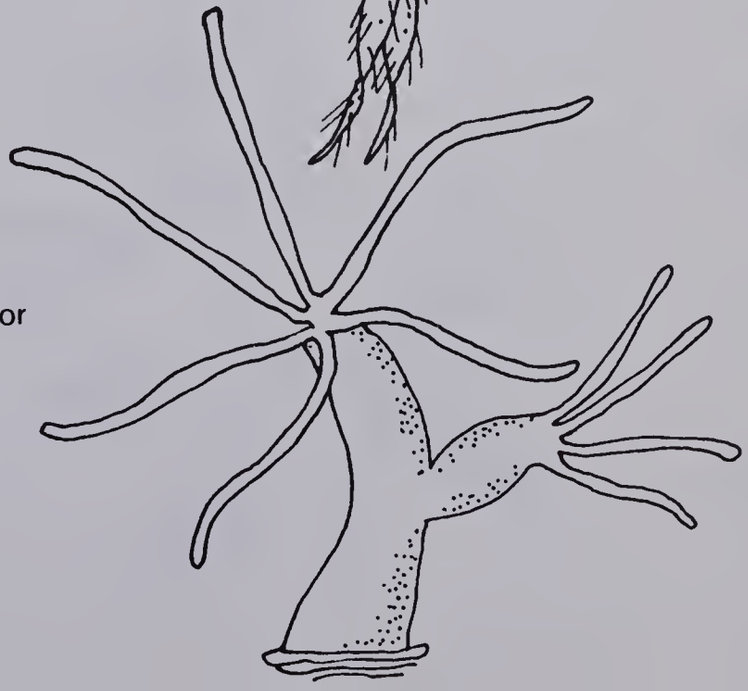
rotaria
size: 0.1 to 0.5 mm

location: pond and slow-flowing stream water

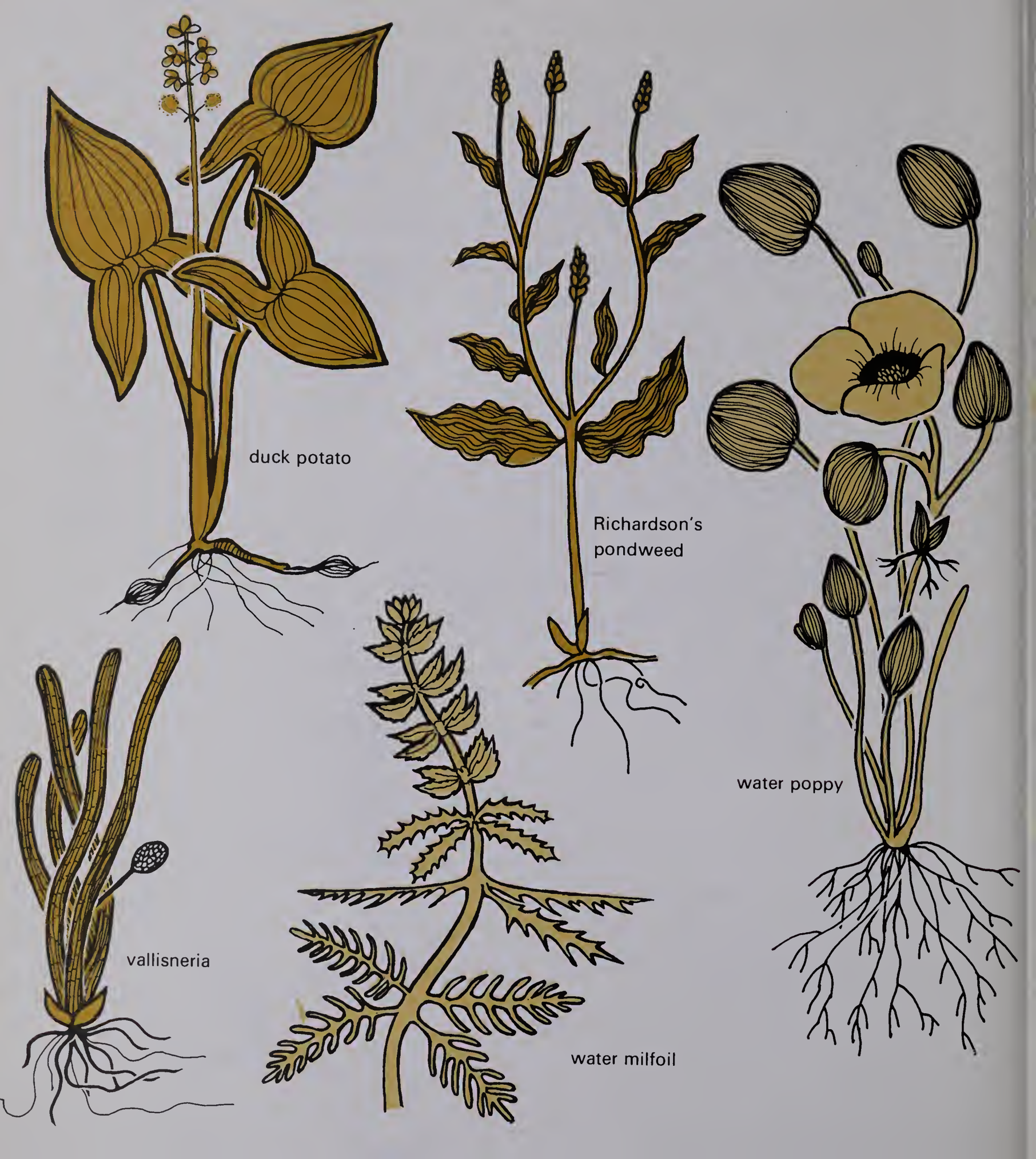


podura
size: 1 to 1.5 mm
location: still water





hydra size: 4 mm
location: on vegetation such as undersurface of lily pads, or underwater weeds


duck potato
Richardson's pondweed
water poppy
vallisneria
water milfoil

Activity 3:
WOODLAND STREAM BANKS

MATERIALS
Notebook and pencil

METHOD
Look carefully as you walk along a woodland stream. Are the plants growing near the stream different from those growing a few feet or paces from the stream? Suggest reasons for the pattern of plant growth that you see.

How are the rocks at the water's edge different from those a few paces away? Compare them with the rocks in the stream.

What effect does the spray near a waterfall have on the surrounding area?

Are the animals in and around rocks and logs near the water different from those in similar places some distance from the stream? Try to explain any observations you make.

Can you find any signs that the stream floods? What are possible effects of flooding? What signs indicate that the stream may dry up at times?

What signs of birds, mice, and other animals can you find in and around the stream?

What trees seem to grow better near the water? What trees seem never to be found near the wet areas?

Other Activities

1. Compare streams in woodlands with those in open places. Try to find out what the effect of shade is on the stream. Do some fish like to hide in the shade?
2. Place some stream plants into a well aerated aquarium. Study them with microscopes.
3. Take back to school for closer study *small* numbers of rock insects and other animals.

4. Study the stream in every season so that you begin to know more about life throughout the year. What happens to the animals on the rocks? How do you know that plants are alive all winter? Do animals drink there in winter? Is the stream flooded or dry in different seasons?
5. Watch closely after a rain to see if the banks erode. Do certain parts erode more than others? Why?
6. Throw heavy sand, light sand, gravel, and clay into fast moving parts of the stream. Where do they settle? Why?
7. In the still waters of ponds, marshes and swamps, push fine sieves and nets through the water to collect small plants and animals. Examine carefully what you find. Use a hand lens and microscope. What immature insects do you find? How do the small animals move? Search the mud, clay and sand on the bottom for living things. Spread the material thinly and look for the movement of worms, insects and other animals.
   In the running water of creeks and streams, look on the under surface of rocks for living things. In particular, examine rocks from riffly sections of streams.
8. Study the life-histories of insects that spend part of their life in water; dragonflies, mosquitoes, blackflies, and mayflies, for example. Look for the immature stages in water.

Using Microscopes

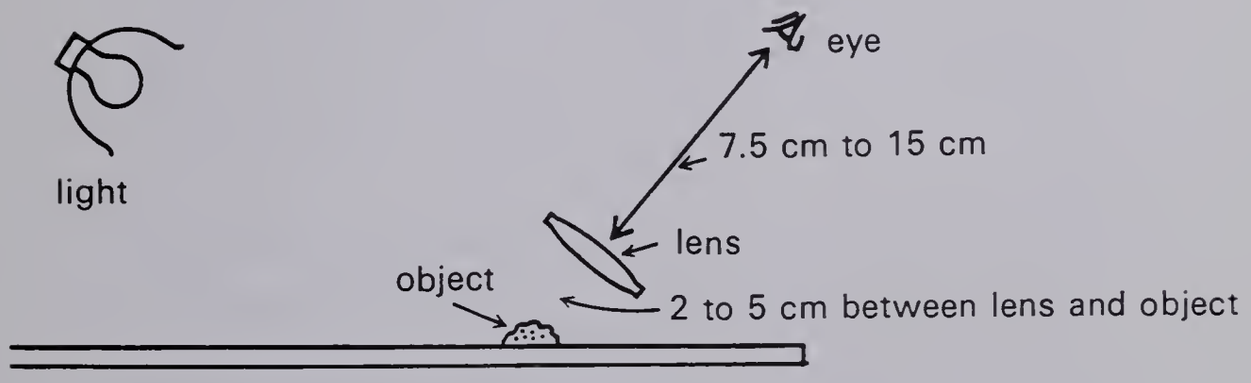
Microscopes, including the hand lens, are the single most important aids to learning about nature.

The Hand Lens

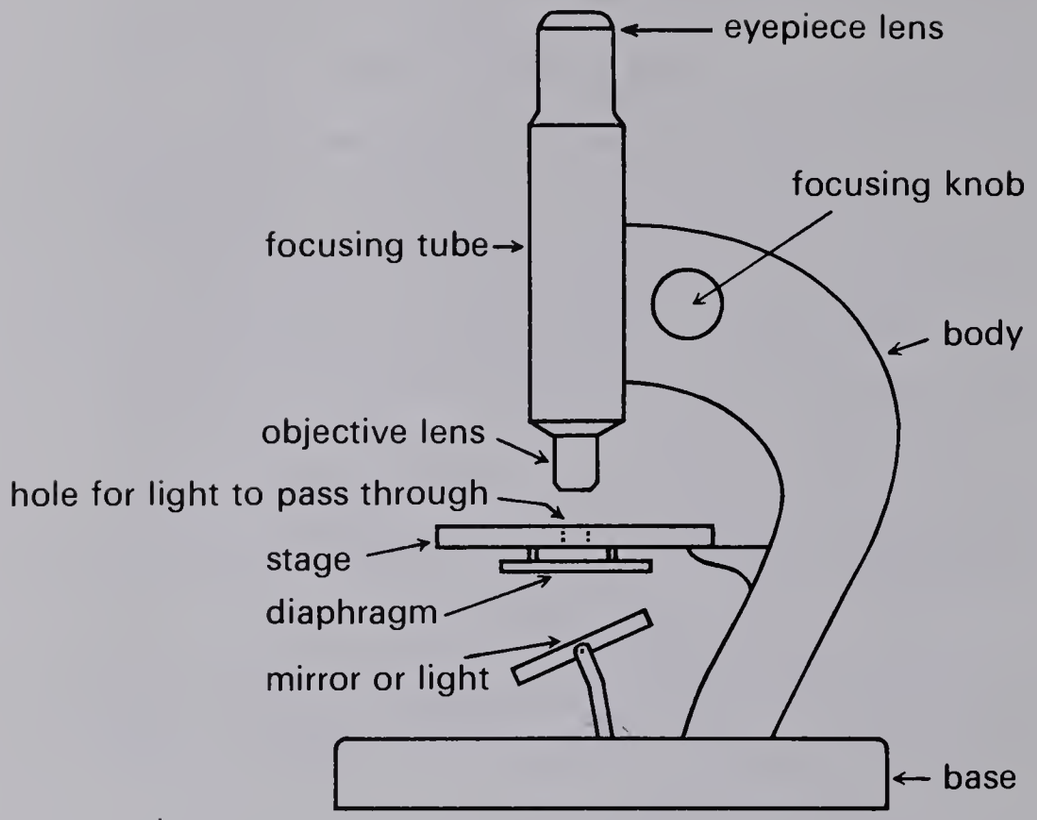
This simple microscope can open up new worlds for you. It will make the object appear larger than it actually is. Some make things seem about twice their normal size. They are called 2X lenses. Others may make things appear four, or six, or eight times as large. These are 4X, 6X, and 8X lenses. A 10X lens is about as much as you will need. The most useful lenses are about 3X to 8X.

Hold the lens about 2 to 5 cm from the specimen. You can usually tell when a lens is at the right distance. High magnification lenses (e.g. 8X) will probably be held closer to the object than low ones.

There is no advantage in holding the lens near to the eye. A lens about 15 cm from the eye should be comfortable to use. High power (8X, 10X) ones may be held closer and are usually harder to use.



The Microscope

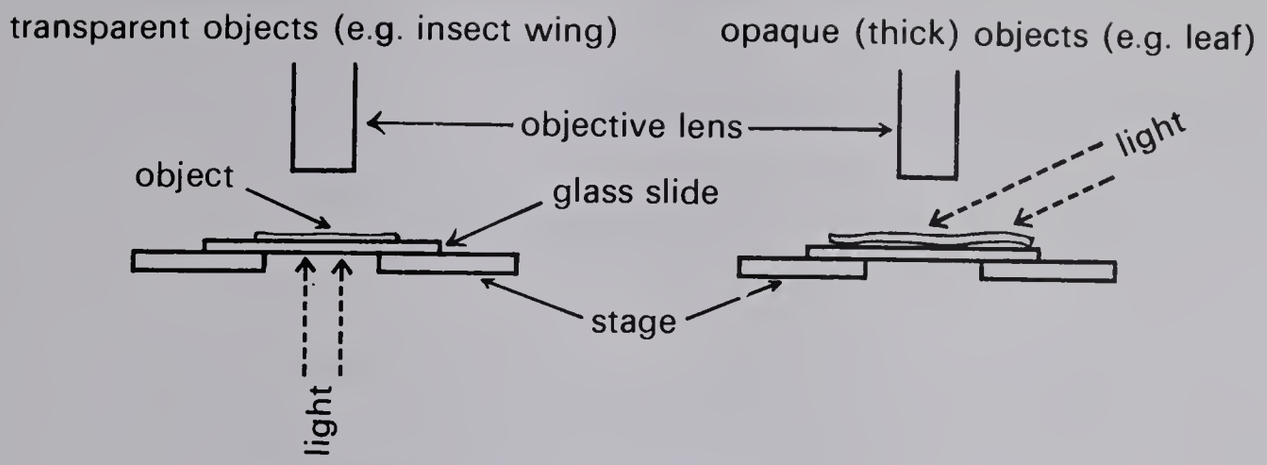


Microscopes may vary a little from this one. Instead of a focusing knob, some microscopes have tubes that are turned for focusing. Some will not have a diaphragm. Others will have a built-in light instead of a mirror. Some microscopes have two lights. One is below the stage and the other shines light on the stage.

Put the object to be studied on a glass slide. Then place the slide on the stage under the objective lens.

If the specimen is transparent and thin, shine the light through it from below the stage. Use the mirror or built-in light. One example is an insect wing.

Thicker objects such as leaves should have light shining on them from above.



A piece of newspaper with some printing on it makes a good object to practise with. Place it on the stage. Shine light through it from below. Shine light on it from above. What differences do you see? Which lighting seems best? How do the letters look when you see them in the microscope?

What happens as you change the focus?

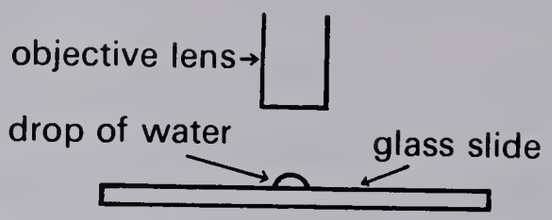
What happens when you change the diaphragm?

Good rules to follow when focusing are:

1. Lower the tube until the lens is close to the object. (Watch from the side.)
2. Put your eye to the eyepiece.
3. Slowly move the tube away from the object until the object is in focus. This method means you will not jam the lens down into the specimen. It protects the microscope and the specimen.

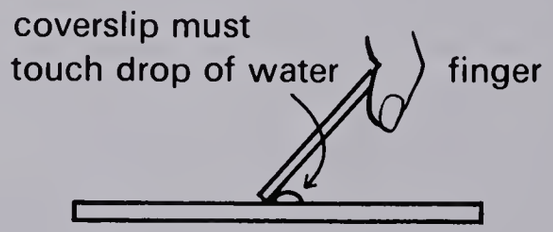
If the microscope has a diaphragm, the best viewing should be when there is just enough light coming through to see well. Too much light makes a poorer image.

For examining drops of water, put the drop on a glass slide.

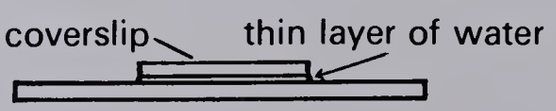


You must be careful that the objective lens does not touch the drop. Look for little plants and animals. You may have to change the focus as the animals swim up and down in the drop.

A coverslip is a small circle or square of thin plastic or glass. It is used to flatten and cover drops of water.



then let coverslip down on the water



A drop that is too small will have air bubbles in it under the coverslip. If this happens, lift the coverslip and start again with a larger drop.

A microscope of more than 50 power (50X) is of no real value in an elementary school. It is more difficult to use than one of 20X to 50X, and rarely helps you to understand what you are looking at.

BOOKS TO READ

Bennet, D. P., and Humphries, D. A. *Introduction to Field Biology.* London: E. Arnold, 1965.

Edwars, C.A. "Soil Pollutants and Soil Animals." *Scientific American*, April, 1969.

Needham, J.G., and Needham, P.R. *Guide to the Study of Freshwater Biology*. 5th ed. San Francisco: Holden-Day, 1962.

Phillips, E.A. *Methods of Vegetation Study*. New York: Holt, Rinehart & Winston, 1959.

Proctor, E. *Nature Study for Primary Schools*. London: Evans Brothers, 1962.

Savory, T. H. "Hidden Lives." *Scientific American*, July, 1968.

Federal and Provincial Government Departments. Departments such as Agriculture, Lands and Forests, as well as others, publish many good books and pamphlets.

Golden Nature Guides and Golden Field Guides. New York: Golden Press, Western Publishing Co. There are over 20 books in these series. They are inexpensive and handy guides to the most common aspects of nature subjects.

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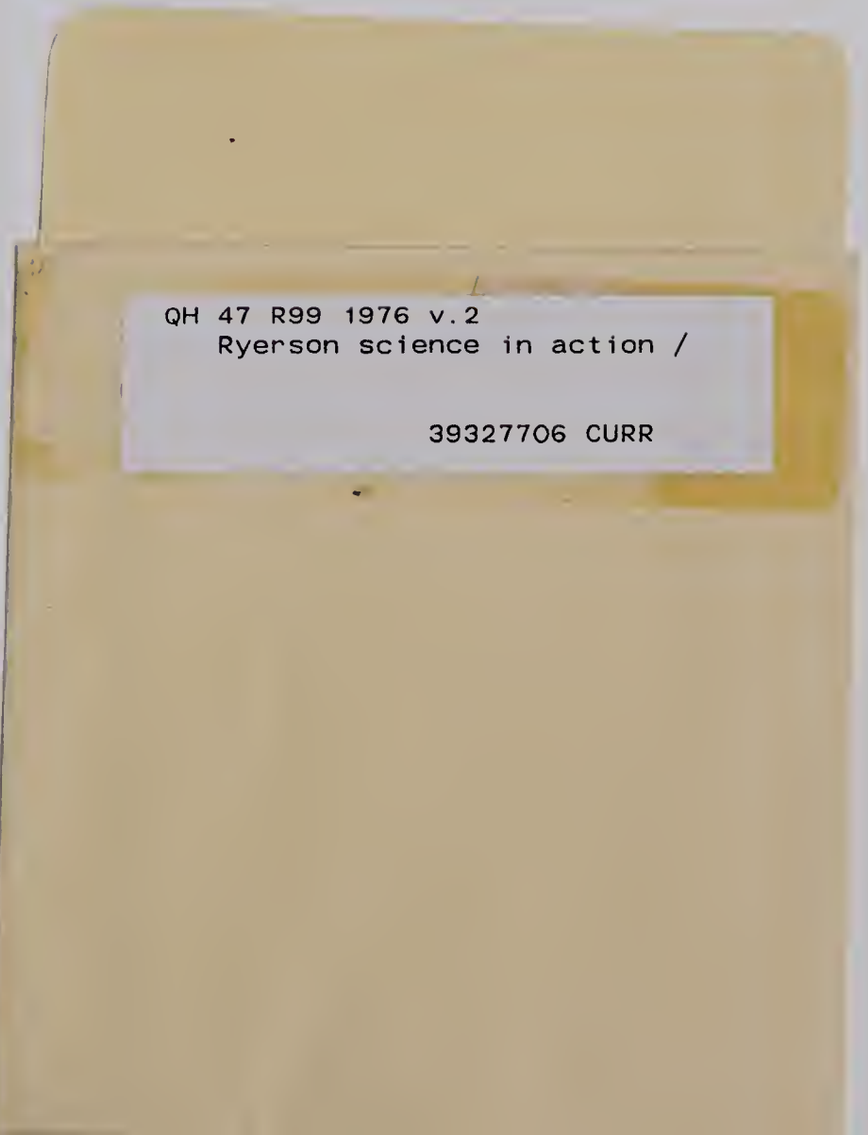

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